472

C-MOS laser displacement sensor

CD33 series

CE

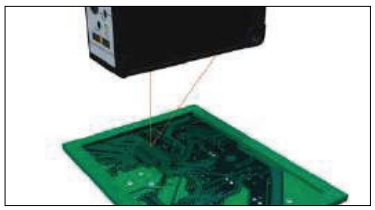
Half-palm size. Ideal for built-in use with smaller machines.

- **Specular reflection types have been added to the line up**
- **Control units for Mitsubishi Electric PLC are available**

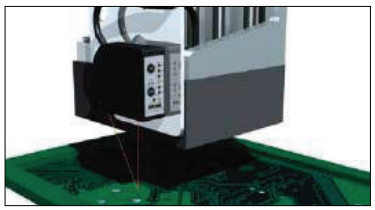
Related products

Ultra-high accuracy	Connecting to MELSEC-Q	Compact type
CDX 	UQ1-02 	CD22 
P.438	P.520	P.464

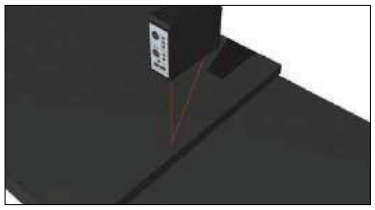
Substrate warpage measurement



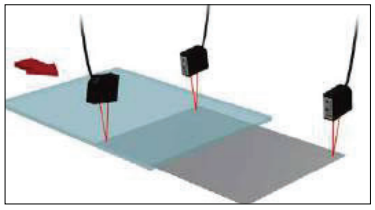
Height measurement of mounted parts



Seam detection on rubber sheeting



Mask height control and glass substrate thickness measurement (Specular reflection type)



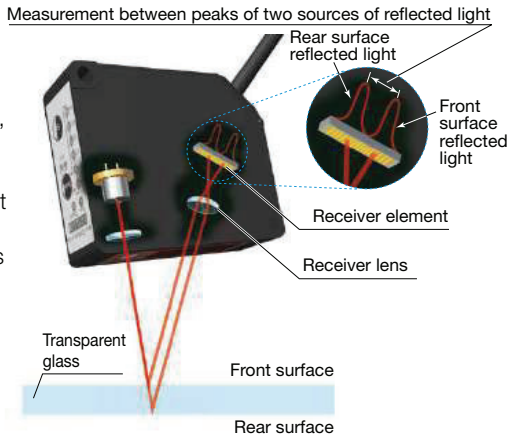
Specular reflection types

for measurements of specular and transparent objects.

Specular reflection types have been added to the line up to enable the measurement of transparent objects such as glass workpiece, as well as specular objects such as wafers, etc. This means that transparent and specular objects that were difficult to measure using diffuse-reflective types can now be measured with stability.

Thickness measurements also possible

When using a specular reflection type to measure transparent objects, not only surface displacement, but also thickness can be measured. As shown below, when the laser light is emitted at an angle, light reflected from both the front and rear surfaces of the glass are received by receiver element. Thickness measurements are possible by measuring between the peaks of these reflected light forms.

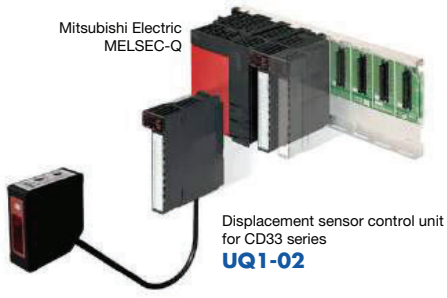


Direct connection to Mitsubishi Electric PLCs

The UQ1-02 displacement sensor control unit that can be connected to the Mitsubishi Electric MELSEC-Q series!
In addition to the fact that absolutely no communications settings are necessary, by using the specialized UQ1 Navigator software it is possible for any one to perform set up easily in a short period of time.

*Can be used with the RS-422 type of the CD33 series

UQ1-02 description P.520



OPTEX FA

Selection table

Type	Measurement range	Repeat accuracy	Analog output/serial interface	Control output	Model (Models in parentheses are connector types)	
					NPN type	PNP type
Diffuse-reflective type (Laser Class 2)	30 ±4 mm	2 µm (4 µm*)	4 to 20 mA	2ch	**CD33-30NA** (CD33-30CNA)	**CD33-30PA** (CD33-30CPA)
			0 to 10 V		**CD33-30NV** (CD33-30CNV)	**CD33-30PV** (CD33-30CPV)
			RS-422	1ch	**CD33-30N-422** (CD33-30CN-422)	**CD33-30P-422** (CD33-30CP-422)
	50 ±10 mm	5 µm (8 µm*)	4 to 20 mA	2ch	**CD33-50NA** (CD33-50CNA)	**CD33-50PA** (CD33-50CPA)
			0 to 10 V		**CD33-50NV** (CD33-50CNV	**CD33-50PV** (CD33-50CPV)
			RS-422	1ch	**CD33-50N-422** (CD33-50CN-422)	**CD33-50P-422** (CD33-50CP-422)
	85 ±20 mm	10 µm (15 µm*)	4 to 20 mA	2ch	**CD33-85NA** (CD33-85CNA)	**CD33-85PA** (CD33-85CPA)
			0 to 10 V		**CD33-85NV** (CD33-85CNV)	**CD33-85PV** (CD33-85CPV)
			RS-422	1ch	**CD33-85N-422** (CD33-85CN-422)	**CD33-85P-422** (CD33-85CP-422)
	120 ±60 mm	30 µm (45 µm*)	4 to 20 mA	2ch	**CD33-120NA** (CD33-120CNA)	**CD33-120PA** (CD33-120CPA)
			0 to 10 V		**CD33-120NV** (CD33-120CNV)	**CD33-120PV** (CD33-120CPV)
			RS-422	1ch	**CD33-120N-422** (CD33-120CN-422)	**CD33-120P-422** (CD33-120CP-422)
	250 ±150 mm	75 µm (100 µm*)	4 to 20 mA	2ch	**CD33-250NA** (CD33-250CNA)	**CD33-250PA** (CD33-250CPA)
			0 to 10 V		**CD33-250NV** (CD33-250CNV)	**CD33-250PV** (CD33-250CPV)
			RS-422	1ch	**CD33-250N-422** (CD33-250CN-422)	**CD33-250P-422** (CD33-250CP-422)
Specular reflection type (Laser Class 1)	26.3 ±2 mm	1 µm	RS-422	1ch	**CD33-L30N-422** (CD33-L30CN-422)	**CD33-L30P-422** (CD33-L30CP-422)
	47.3 ±5 mm	2.5 µm			**CD33-L50N-422** (CD33-L50CN-422)	**CD33-L50P-422** (CD33-L50CP-422)
	82.9 ±10 mm	5 µm			**CD33-L85N-422** (CD33-L85CN-422)	**CD33-L85P-422** (CD33-L85CP-422)

*The repeat accuracy when response time is set to FAST is shown in parentheses.
- For the connector type, please purchase an optional DOL-1208-G05MF connector cable.
- When using a UQ1-02 control unit, select the RS-422 communication type.

Options/Accessories

Connector cable

DOL-1208-G05MF
M12, 8-pin connector cable
Cable length: 5 m

Displacement sensor control unit

UQ1-02
For connecting to the Mitsubishi Electric MELSEC-Q series
* Can be used with the RS-422 type of the CD33 series

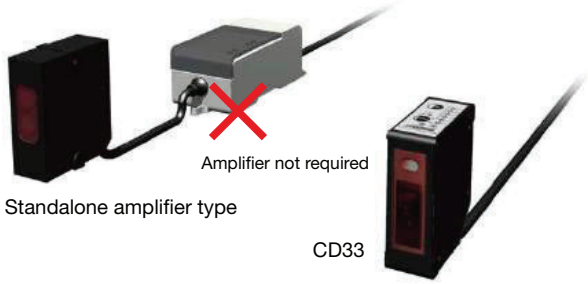
Photoelectric Sensors
Specialized Photoelectric Sensors
Laser Displacement Sensors
C-MOS Built-in Amplifiers
CDX
CDA
LS
CD22
CD33
CD4
CD5
UQ1-01
UQ1-02

C-MOS laser displacement sensor CD33 series

Original built-in technology

Lightweight with a built-in amplifier!

An amplifier and all control functions are integrated into the sensor head. You don't have to worry about space for installing to control panels.
It also features a light weight of approx. 65 g, enabling it to be installed to movable parts such as chip mounters or robot arms.

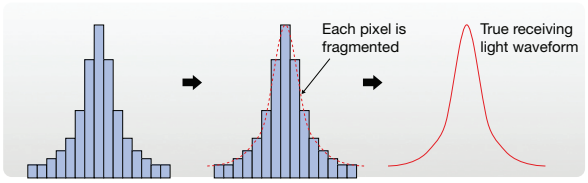


Uses sub-pixel processing and automatic sensitivity switching function

Pursuit of the limits in terms of accuracy and measurement stability!

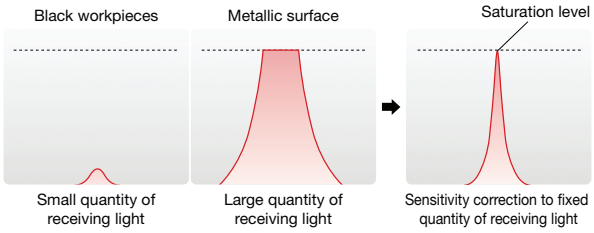
Sub-pixel processing that recognizes true waveforms

Sub-pixel processing is employed that performs recognition by fragmenting each C-MOS element pixel. By accurately detecting the true receiving light waveform, it is possible to correctly measure the distance to a workpiece. Repeat accuracy is also 2 μm* and support is provided for high-accuracy displacement measurement.
*Values with CD33-30N□



High-accuracy sensitivity switching function effective against influence caused by workpiece material and color

The opening degree of the shutter is switched automatically in accordance with the reflection rate of the workpiece. By controlling the receiving light quantity and constantly correcting to the optimal sensitivity, we have succeeded in keeping errors caused by color and materials to an absolute minimum.

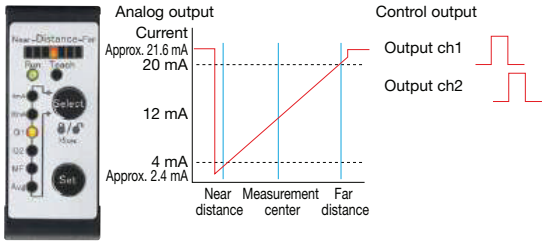


Low cost version that eliminates unnecessary circuits

Realizing a high level of cost performance with a wide output-based lineup

While many of our competitors' displacement sensors have multiple types of measured value outputs, customers can make selections from "analog current + 2ch control output type", "analog voltage + 2ch control output type", "RS-422 + control output type", based on the input device used. Also, by eliminating unnecessary circuits, a highest-in-class level of cost performance has been realized. These laser displacement sensors are highly-accurate, low in cost, and easy to introduce.

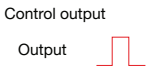
Analog current + 2ch control output type



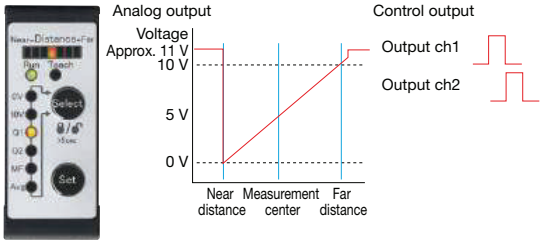
RS-422 + control output type

Not only can measured values be read, but both setting changes and emission stoppage, etc., are possible using RS-422. Also, connection with UQ1-02 displacement sensor control units is possible.

UQ1-02 description P.520



Analog voltage + 2ch control output type



Specifications

Diffuse-reflective type Measurement distance based specifications

Model		CD33-30□□□	CD33-50□□□	CD33-85□□□	CD33-120□□□	CD33-250□□□
Center of measurement range		30 mm	50 mm	85 mm	120 mm	250 mm
Measurement range		±4 mm	±10 mm	±20 mm	±60 mm	±150 mm
F.S. (full scale)		8 mm	20 mm	40 mm	120 mm	300 mm
Light source		Red semiconductor laser, wavelength: 655 nm, Maximum output: 1 mW				
Laser class		IEC/JIS: CLASS 2 FDA: CLASS II				
Spot size*1		0.1 × 0.1 mm	0.5 × 1.0 mm	0.75 × 1.25 mm	1.0 × 1.5 mm	1.75 × 3.5 mm
Linearity		±0.1% F.S.				±0.3% F.S.
Repeat accuracy		2 µm (4 µm when response time is set to FAST)	5 µm (8 µm when response time is set to FAST)	10 µm (15 µm when response time is set to FAST)	30 µm (45 µm when response time is set to FAST)	75 µm (100 µm when response time is set to FAST)
Sampling period		0.5 ms/1 ms/1.5 ms/2 ms				0.75 ms/1 ms/1.5 ms/2 ms
Response time*2 Averaging	Fast	5 ms or less: Averaging 1 time (1 ms) + sensitivity switching time (Max. 4 ms)				7.5 ms or less: Averaging 1 time (1.5 ms) + sensitivity switching time (Max. 6 ms)
	Standard	12.5 ms or less: Averaging 16 times (8.5 ms) + sensitivity switching time (Max. 4 ms)				19 ms or less: Averaging 16 times (13 ms) + sensitivity switching time (Max. 6 ms)
	High-resolution	36.5 ms or less: Averaging 64 times (32.5 ms) + sensitivity switching time (Max. 4 ms)				55 ms or less: Averaging 64 times (49 ms) + sensitivity switching time (Max. 6 ms)
Temperature drift		±0.08%/°C F.S.				
Indicators	Distance indicator	LED bar display on operation surface (25-step)				
	Output indicator	Q1 and Q2 LED lights up during output (orange)				
	Input indicator	MF LED lights up during input (orange)				
MF (multi-function) input		Choose from laser OFF, teaching*3, sample & hold Response time: 3 ms or less				
Connection type		Cable type: Cable length: 2 m (ø5) Connector type: M12, 8-pin				
Protection circuit		Reverse connection protection, overcurrent protection function				
Degree of protection		IP67				
Ambient temperature/humidity		-10 to +45°C / 35 to 85% RH (no freezing or condensation)				
Ambient illuminance		Sunlight: 10,000 lx Incandescent lamp: 3,000 lx				
Vibration resistance		10 to 55 Hz; double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions				
Shock resistance		Approx. 50 G (500 m/s²), 3 times in each of the X, Y, and Z directions				
Warm-up time		Approx. 15 minutes				
Material		Housing: PBT, Front cover: PMMA, Cable: PVC				
Weight without cable		Approx. 65 g				

Diffuse-reflective type Output based specifications

Type		Analog current output type	Analog voltage output type	RS-422 type
Model	NPN type	CD33-□□NA	CD33-□□NV	CD33-□□N-422
	PNP type	CD33-□□PA	CD33-□□PV	CD33-□□P-422
Supply voltage		12 to 24 VDC, ±10/-5%	18 to 24 VDC, ±10/-5%	12 to 24 VDC, ±10/-5%
Current consumption		Max. 85 mA (including analog output)	Max. 55 mA	
Control output	Output channel No.	2ch: Q1, Q2 (default setting of self-diagnosis output for Q2)		1ch: Q2 (default setting of self-diagnosis output)
	Output method	NPN/PNP open collector output, Max. 100 mA / 30 VDC, residual voltage 1.8 V		
Analog output/serial interface		4 to 20 mA, load impedance: 300 Ω or less	0 to 10 V, output impedance: 100 Ω	RS-422 9.6 k to 256 kbps
Applicable regulations		EMC directive (2004/108/EC) / FDA regulations (21 CFR 1040.10)		
Applicable standards		EN 60947-5-7		EN 60947-5-2

<Measurement conditions> The measurement conditions are as follows unless otherwise designated: Ambient temperature of +23°C (normal temperature), Supply voltage 24 VDC, Response time: High-resolution, Center of measurement range, Measurement target: 50 × 50 mm white ceramic.

*1 Defined with center strength $1/e^2$ (13.5%) at the center of measurement range. There may be leak light other than the specified spot size. The sensor may be affected when there is a highly reflective object in the range of the light axis.

*2 The response time is a time in which the sensitivity switching time has been added. The sensitivity switching time fluctuates within a max. range of 4 ms (6 ms for CD33-250N□) depending on measurement conditions. Also, if the sampling period is long, the response time will also increase proportionately.
Ex.: Sampling period 500 µs → 1000 µs: Response time 12.5 ms → Approx. 25 ms

*3 If external teaching is selected, setting items can be changed as shown in the table below depending on the input time thereof.

Setting items	Input time	Setting items	Input time
1st point for span adjustment	70 to 130 ms	1-point teaching of control output Q2 Please input the same time for the 2nd point of 2-point teaching within one minute.	470 to 530 ms
2nd point for span adjustment	170 to 230 ms		
1-point teaching of control output Q1 Please input the same time for the 2nd point of 2-point teaching within one minute.	270 to 330 ms	Inverted 1-point teaching of control output Q2	570 to 630 ms
		Offset (zero reset)	670 to 5000 ms
Inverted 1-point teaching of control output Q1	370 to 430 ms	Clearing offset	5000 ms or more

Specifications

Specular reflection type

Model	NPN type	CD33-L30□N-422	CD33-L50□N-422	CD33-L85□N-422
	PNP type	CD33-L30□P-422	CD33-L50□P-422	CD33-L85□P-422
Measurement target object		Specular object, glass		
Center of measurement range		26.3 mm	47.3 mm	82.9 mm
Measurement range		±2 mm	±5 mm	±10 mm
F.S. (full scale)		4 mm	10 mm	20 mm
Light source		Red semiconductor laser, wavelength: 655 nm, Maximum output: 390 µW		
Laser class		IEC/JIS: CLASS 1 FDA: CLASS II		
Spot size*1		0.1 × 0.1 mm		
Linearity		±0.2% F.S.		
Repeat accuracy		1 µm	2.5 µm	5 µm
Sampling period		0.5 (default setting), 4-stage switching is possible between 1 ms, 1.5 ms, 2 ms		
Response time*2 Averaging	Fast	5 ms or less: Averaging 1 time (1 ms) + sensitivity switching time (Max. 4 ms)		
	Standard	12.5 ms or less: Averaging 16 times (8.5 ms) + sensitivity switching time (Max. 4 ms)		
	High-resolution	36.5 ms or less: Averaging 64 times (32.5 ms) + sensitivity switching time (Max. 4 ms)		
Control output	Output channel No.	1ch: Q2 (default setting of self-diagnosis output)		
	Output method	NPN/PNP open collector output, Max. 100 mA / 30 VDC, residual voltage 1.8 V		
Analog output		Not equipped		
Serial interface		RS-422 9.6 k to 256 kbps		
Temperature drift		±0.08%/°C F.S.		
Indicators	Distance indicator	LED bar display on operation surface (25-step)		
	Output indicator	Q2 LED lights up during output (orange)		
	Input indicator	MF LED lights up during input (orange)		
MF (multi-function) input		Choose from laser OFF, teaching*3, sample & hold Response time: 3 ms or less		
Supply voltage		12 to 24 VDC, ±10/-5%		
Current consumption		Max. 55 mA		
Connection type		Cable type: Cable length: 2 m (ø5) Connector type: M12, 8-pin		
Protection circuit		Reverse connection protection, overcurrent protection function		
Degree of protection		IP67		
Ambient temperature/humidity		-10 to +45°C / 35 to 85% RH (no freezing or condensation)		
Ambient illuminance		Sunlight: 10,000 lx Incandescent lamp: 3,000 lx		
Vibration resistance		10 to 55 Hz; double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions		
Shock resistance		Approx. 50 G (500 m/s^2), 3 times in each of the X, Y, and Z directions		
Applicable regulations		EMC directive (2004/108/EC) / FDA regulations (21 CFR 1040.10)		
Applicable standards		EN 60947-5-2		
Warm-up time		Approx. 15 minutes		
Material		Housing: PBT, Front cover: PMMA, Cable: PVC		
Weight without cable		Approx. 65 g		

<Measurement conditions>
The measurement conditions are as follows unless otherwise designated: Ambient temperature of +23°C (normal temperature), Supply voltage 24 VDC, Response time: High-resolution, Center of measurement range, Measurement target: aluminum deposition mirror.

*1 Defined with center strength 1/e^2 (13.5%) at the center of measurement range. There may be leak light other than the specified spot size. The sensor may be affected when there is a highly reflective object in the range of the light axis.

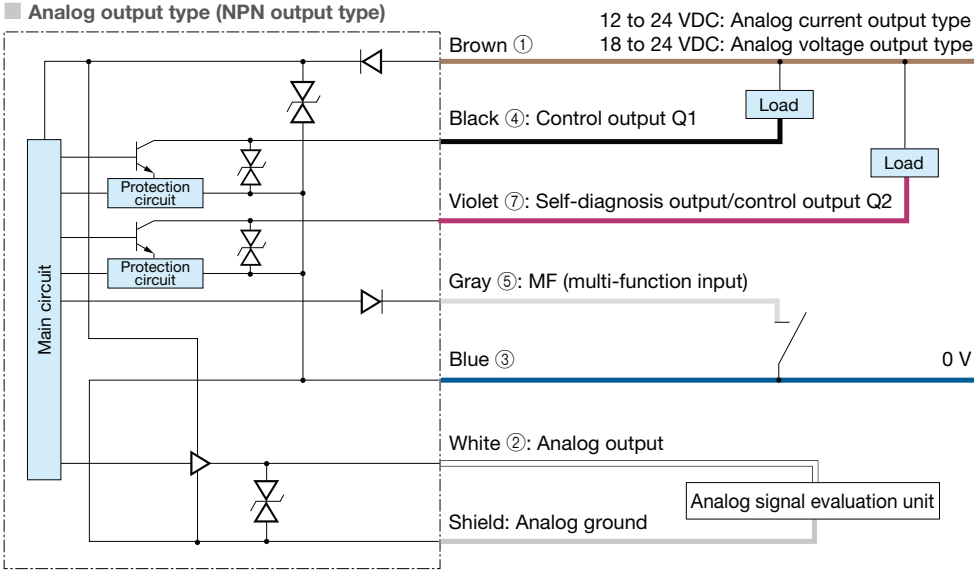
*2 The response time is a time in which the sensitivity switching time has been added. The sensitivity switching time fluctuates within a max. range of 4 ms depending on measurement conditions. Also, if the sampling period is long, the response time will also increase proportionately.
Ex.: Sampling period 500 µs → 1000 µs: Response time 12.5 ms → Approx. 25 ms

*3 If external teaching is selected, setting items can be changed as shown in the table below depending on the input time thereof.

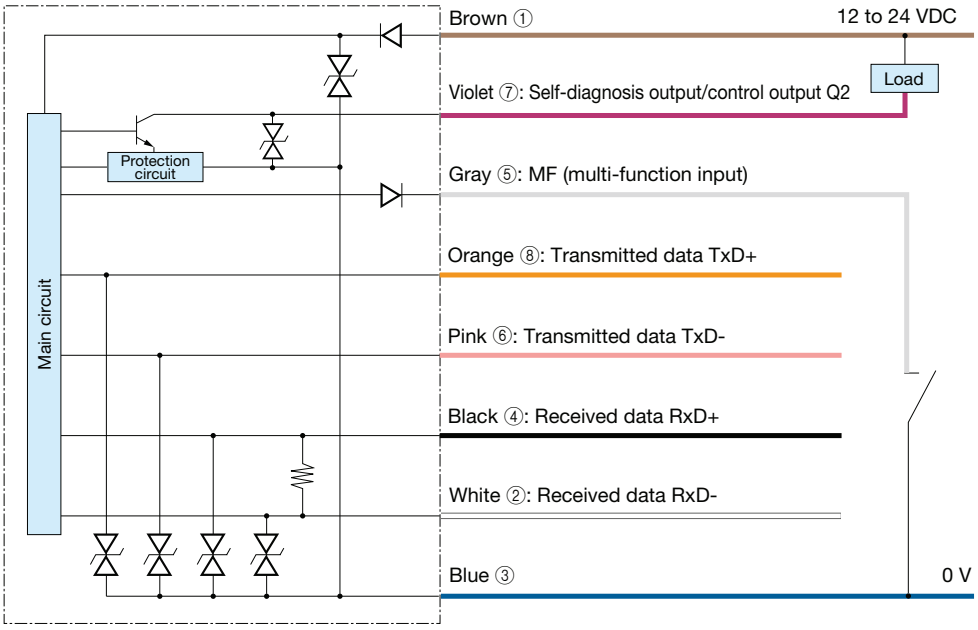
Setting items	Input time
1-point teaching of control output Q2 Please input the same time for the 2nd point of 2-point teaching within one minute.	470 to 530 ms
Inverted 1-point teaching of control output Q2	570 to 630 ms
Offset (zero reset)	670 to 5000 ms
Clearing offset	5000 ms or more

I/O circuit diagram

Analog output type (NPN output type)



RS-422 type (NPN output type)



Connector type

(Pin configuration)

Sensor side

① Supply voltage
② Analog output/ Received data RxD-
③ 0 V
④ Control output Q1/ Received data RxD+

Connector cable side

⑤ Multi-function input
⑥ Transmitted data TxD-
⑦ Self-diagnosis output/ control output Q2
⑧ Transmitted data TxD+

Connecting

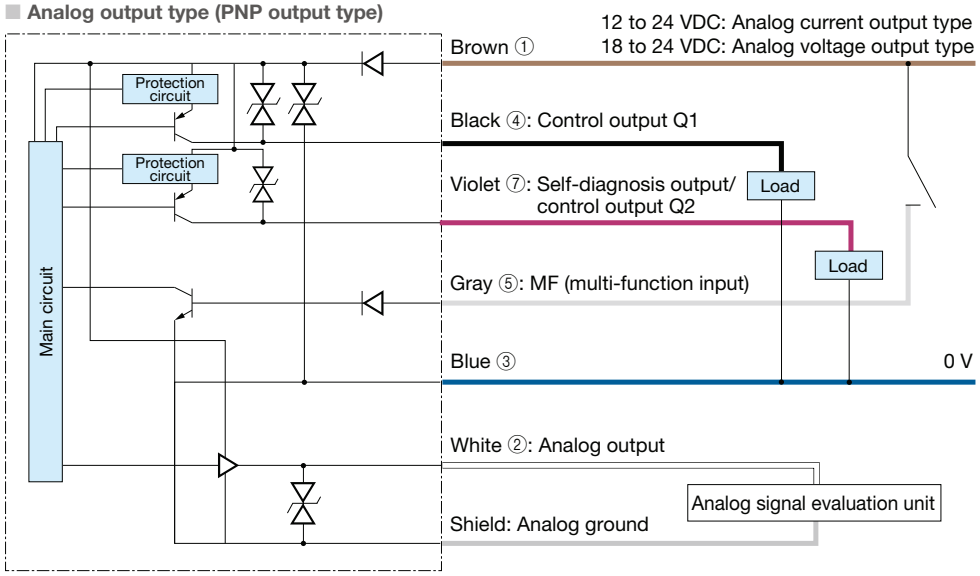
- ① to ⑧ are connector pin No.
- Because the connector type is not equipped with an analog ground wire, please use by connecting the analog ground terminal of the analog input device and 0 V of the sensor power supply.

Notes

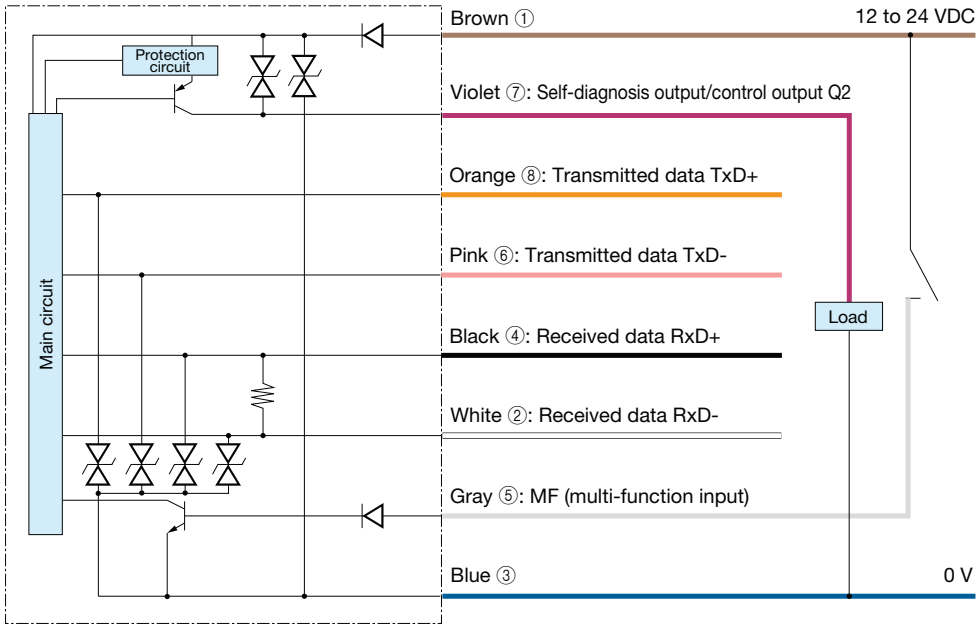
- When using a switching regulator for the power supply, be sure to ground the frame ground terminal.
- Avoid wiring in parallel with or in the same piping as high-voltage wires or power lines. Doing so may lead to malfunctions caused by noise. Also, shorten the power supply and signal wires as much as possible.
- Avoid using the transient state while the power is on (approx. 1.5 s).

I/O circuit diagram

Analog output type (PNP output type)



RS-422 type (PNP output type)



Connector type

(Pin configuration)

Sensor side

① Supply voltage
② Analog output/ Received data RxD-
③ 0 V
④ Control output Q1/ Received data RxD+

Connector cable side

⑤ Multi-function input
⑥ Transmitted data TxD-
⑦ Self-diagnosis output/ control output Q2
⑧ Transmitted data TxD+

Connecting

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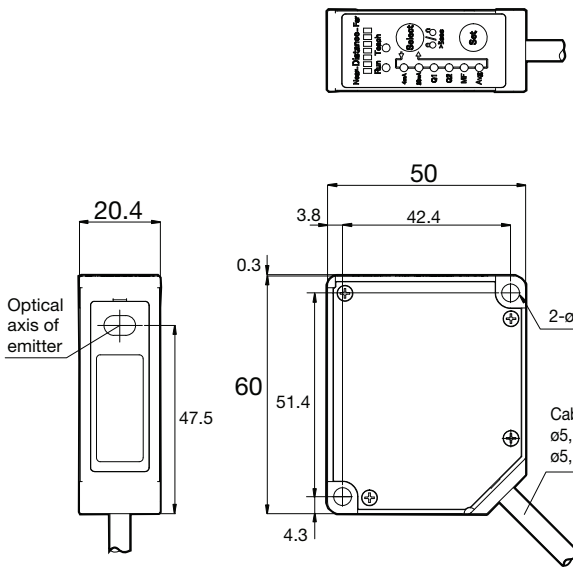
Dimensions

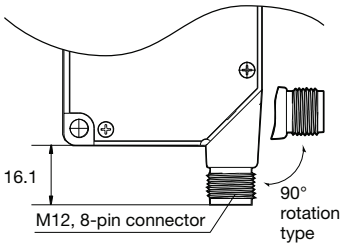
Sensor

(Unit: mm)

■ Cable type

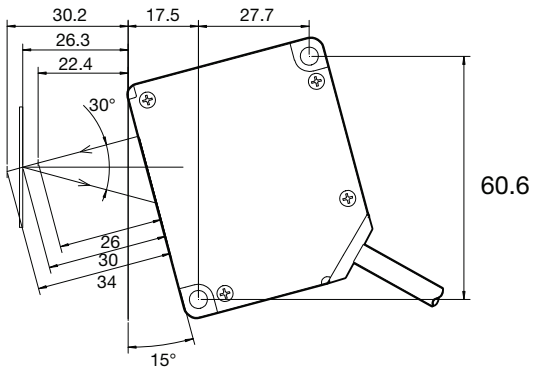


■ Connector type

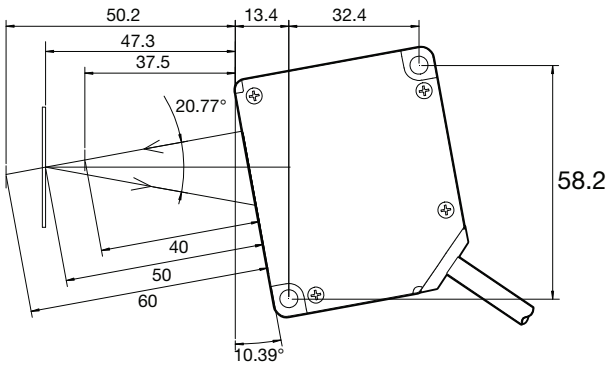


Specular reflection type (side view)

CD33-L30□-422



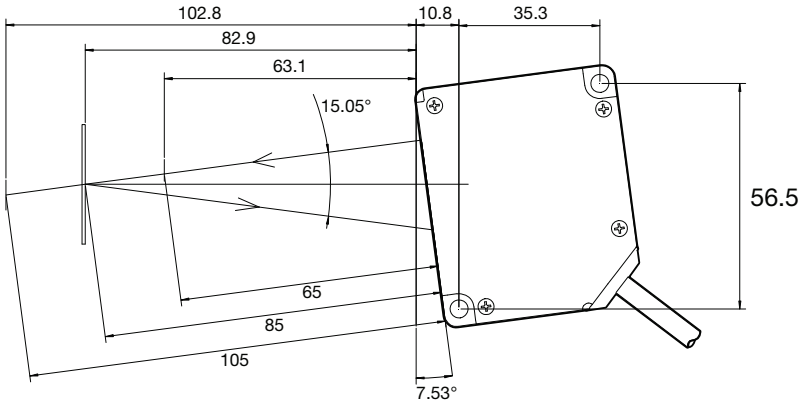
CD33-L50□-422



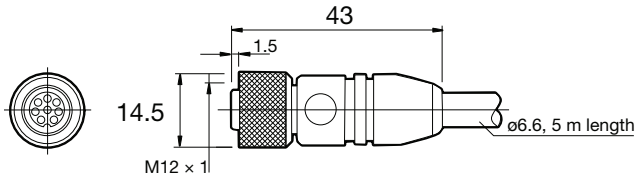
Dimensions

CD33-L85□-422

(Unit: mm)



Connector cable
DOL-1208-G05MF



Cable material: PVC
Conductor cross-section: 0.25 mm²

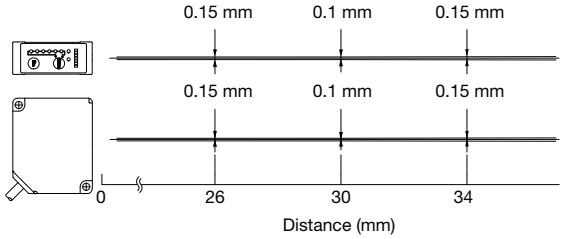
Photoelectric Sensors
Specialized Photoelectric Sensors
Laser Displacement Sensors
C-MOS Built-in Amplifiers
CDX
CDA
LS
CD22
CD33
CD4
CD5
UQ1-01
UQ1-02

Typical characteristic data

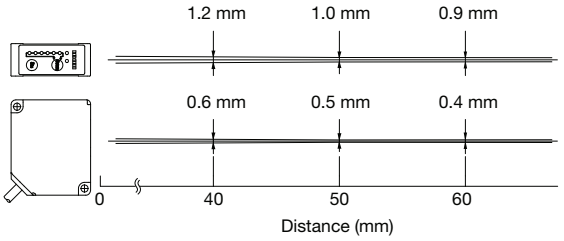
Spot size

Diffuse-reflective type

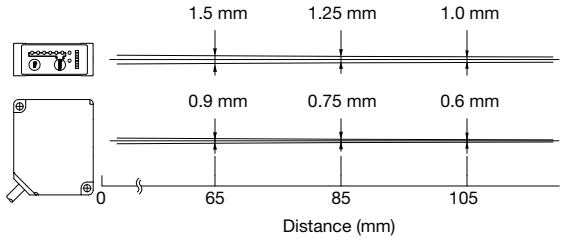
CD33-30□



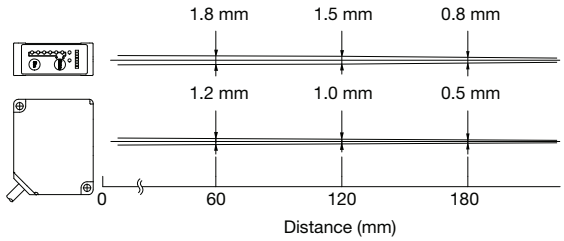
CD33-50□



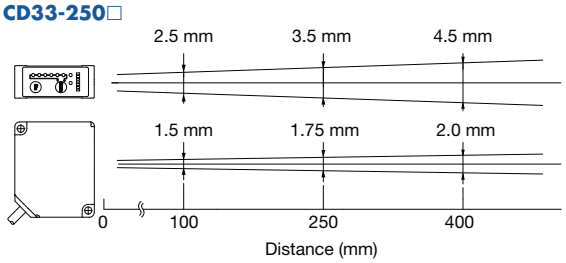
CD33-85□



CD33-120□

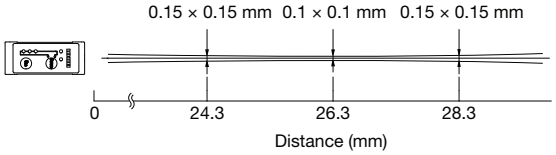


CD33-250□

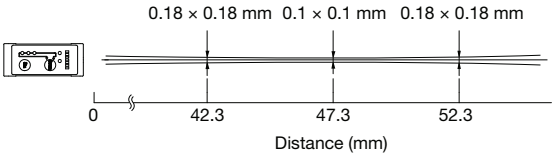


Specular reflection type

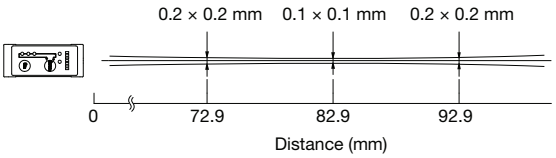
CD33-L30□-422



CD33-L50□-422



CD33-L85□-422



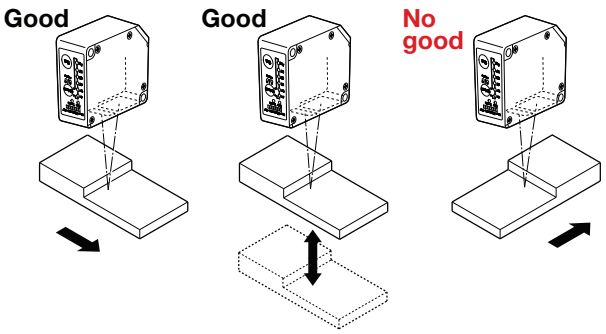
Installation of sensor

Warning

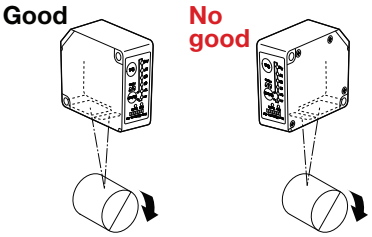
- Install the sensor at a height that is not at worker eye level.
- Make sure to turn the power off before connecting or removing sensors.

Mount the sensor head so that the detection surface (optical plane) is always parallel to the detection target. Adjust the target so that the spot aligns with the detection position, and ensure that the bar graph distance indicator lights up orange at the reference detection surface (center of change).

Workpieces with large fluctuations in height difference or color

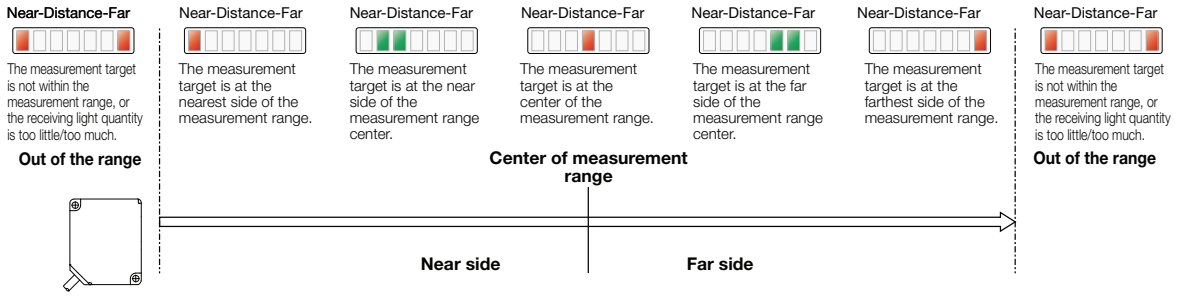


Rotating workpieces



Bar graph distance indicator

By combining individual lighting/multiple lighting and lighting/flashing patterns, distances will be displayed in 25 steps (the following example shows 5 steps).



Warning

Do not look directly at the laser or intentionally aim the laser beam in another person's eyes.
Doing so may cause damage to the eyes or health.

Precautions for laser use

This product emits a Class 1/Class 2 (II) visible laser beam that is compliant with JIS C 6802/IEC/FDA laser safety standards. Because English language warnings indicating the sensor as Class 1 or Class 2 (II), as well as explanation labels, are located on the side of the sensor, please replace these warnings/ explanation labels with the Japanese language warnings/ explanation labels included in the box when using in Japan.

Type of laser used in this product

Type	Red semiconductor laser
Wavelength	655 nm
Output	390 µW/1 mW

If you install this product in a piece of machinery that will then be exported to the United States, it is necessary to follow laser standards as stipulated by the American Food and Drug Administration (FDA). This product has already been submitted to the CDRH (Center for Devices and Radiological Health). (Please inquire for details.)

Photoelectric Sensors
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UQ1-02